GEOLOGIC INTERPRETATION OF AEROMAGNETIC MAP

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AEROMAGNETIC MAP AND GEOLOGIC INTERPRETATION OF AEROMAGNETIC MAP, McCARTHY QUADRANGLE, ALASKA

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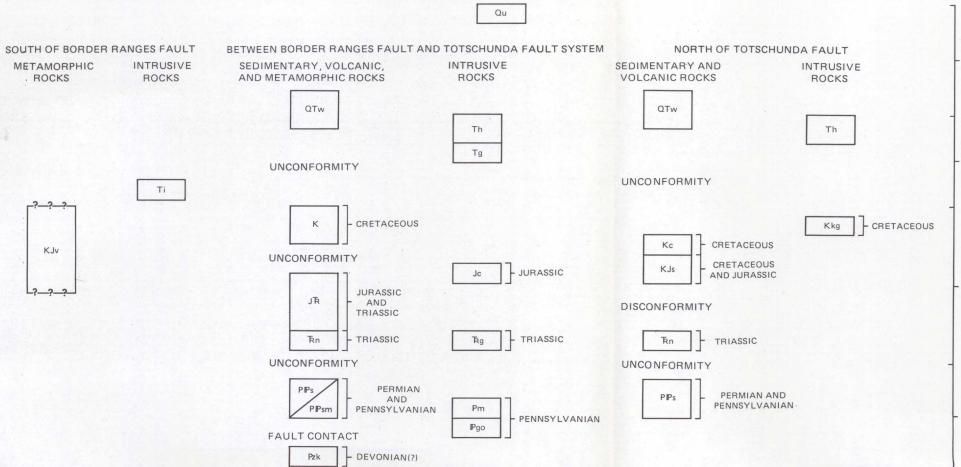
FOLIO OF THE MCCARTHY QUADRANGLE, ALASKA

CASE AND MOCKEVETT- GEOLOGIC INTERPRETATION OF AEROMAGNETIC MAP

EXPLANATION FOR GENERALIZED GEOLOGIC MAP (GEOLOGY GENERALIZED FROM MacKEVETT, 1976)

CORRELATION OF MAP UNITS

SURFICIAL DEPOSITS



DESCRIPTION OF MAP UNITS

SURFICIAL DEPOSITS UNCONSOLIDATED SEDIMENTARY DEPOSITS (Quaternary) SOUTH OF BORDER RANGES FAULT

METAMORPHIC ROCKS KJv VALDEZ GROUP (Cretaceous and Jurassic?) INTRUSIVE ROCKS

INTRUSIVE ROCKS (Eocene?) Typically, foliated granodiorite and tonalite BETWEEN BORDER RANGES FAULT AND TOTSCHUNDA FAULT SYSTEM

SEDIMENTARY, VOLCANIC, AND METAMORPHIC ROCKS WRANGELL LAVA (Quaternary and Tertiary) Chiefly subaerial andesitic lava flows and tephra; includes local subaerial sedimentary rocks of the Frederika Formation

MARINE SEDIMENTARY ROCKS (Upper and Lower Cretaceous) Includes MacColl Ridge, Chititu, Moonshine Creek, Schulze, and Kennicott Formations, and unnamed Lower Cretaceous rocks MARINE SEDIMENTARY ROCKS (Jurassic and Triassic) Includes Root Glacier, Nizina Mountain, Lubbe Creek, and

McCarthy Formations, Kotsina Conglomerate, and Nizina and Chitistone Limestones NIKOLAI GREENSTONE (Upper and (or) Middle Triassic) Mainly subaerial tholeiltic basalt; includes subordinate Chitistone Limestone north of Totschunda fault system

SKOLAI GROUP (Permian and Pennsylvanian) As mapped includes a few scattered remnants of Middle Triassic sedimentary rocks in northeastern part of quadrangle METAMORPHOSED SKOLAI GROUP (Permian and Pennsylvanian) Includes a few small outcrops of serpentinized ultramafic rocks near Border Ranges fault

KASKAWULSH GROUP OF KINDLE (1953) (Devonian?) INTRUSIVE ROCKS

FELSIC HYPABYSSAL ROCKS (Pliocene) Mainly porphyritic dacite GRANODIORITE (Pliocene) Unfoliated granodiorite with local mafic border facies

CHITINA VALLEY BATHOLITH (Jurassic) Mainly foliated quartz monzodiorite, granodiorite, and tonalite MONZONITIC-GRANITIC COMPLEX (Pennsylvanian) Mainly nonfoliated quartz monzonite and granite, local mafic

GABBRO AND ORTHOGNEISS (Pennsylvanian)

NORTH OF TOTSCHUNDA FAULT SYSTEM SEDIMENTARY AND VOLCANIC ROCKS

WRANGELL LAVA See above

CHISANA FORMATION (Lower Cretaceous) Marine and subaerial volcaniclastic and volcanic rocks NUTZOTIN MOUNTAINS SEQUENCE (Lower Cretaceous and Upper Jurassic) NIKOLAI GREENSTONE See above

SKOLAI GROUP See above INTRUSIVE ROCKS FELSIC HYPABYSSAL ROCKS See above

KLEIN CREEK PLUTON (Cretaceous) Chiefly granodiorite

Contact; dotted where concealed High-angle fault; dotted where concealed ▲▲ ... Thrust fault; sawteeth on upper plate. Dotted where concealed

NOTE: Areas without letter symbols are glaciers and snowfields

Approximate boundary of magnetic anomaly showing relative amplitude of positive anomalies:

EXPLANATION FOR GEOLOGIC INTERPRETATION OF AEROMAGNETIC MAP

I – Anomaly amplitude 50-200 gammas II - Anomaly amplitude 100-300 gammas III - Anomaly amplitude 300-600 gammas IV - Anomaly amplitude 500-1500 gammas Geologic symbols indicate which rock units may cause the anomaly. The most probable unit is underlined

Approximate boundary of relative negative anomaly believed to be caused by reversed remanent magnetization. Queried where the negative anomaly may be caused by terrain effects

Magnetic lineament, generally located along steepened magnetic gradients DISCUSSION

Aeromagnetic anomalies in the McCarthy quadrangle (sheet 1) are exceedingly complex. which is to be expected from the presence of many magnetic rock units. The aeromagnetic survey was flown at a nominal height of 300 m (1000 ft) above the ground, but because of extreme topographic relief, it seems certain that a constant height above ground could not be maintained. This practical flying problem, plus the fact that the topography is not two dimensional, adds to the complexity of the magnetic field as measured at the aircraft. Man apparent anomalies caused by terrain effects appear on the map; one of the more prominent a northwest-trending low in Tps. 5 and 6 S., Rs. 17 and 18 E. that coincides closely with the narrow canyon of Glacier Creek. Many others can be identified by close comparison of the drape flying" are discussed by Griscom (1975) in greater detail for the Nabesna quadrangle,

Virtually all intrusive, extrusive, and metamorphic units in the McCarthy quadrangle are variably magnetic. Only the sedimentary rock sequences are nearly nonmagnetic. Thus, where prominent anomalies occur over exposed sedimentary rocks, it is most probable that the anomalies are caused by the underlying magnetic units or by concealed instrusive bodies in the unit. A detailed geologic map of the McCarthy quadrangle (MacKevett, 1976) should be inspected for interpretation of specific aeromagnetic anomalies. Careful comparison of the magnetic map with the geologic map clearly indicates that many anomalies are composite, arising from superimposed effects of adjacent rock units. It should be borne in mind that most magnetic anomalies are directly related to the amount of magnetite in the rock. If magnetite content in a rock unit varies, for example, from 0.5 to 1.0 percent, the anomaly amplitudes may vary by 100 percent over a single unit. Magnetic susceptibilities of some of the major

rock units have been measured on samples collected during the geologic mapping (table 1).

TABLE 1.--Magnetic properties of rocks from the McCarthy quadrangle.

Unit on generalized geologic map			susce	ptibility 3emu/cm3	
Wrangell Lava (QTw)Felsic hypabyssal rocks (Th)	8		0.02	- 2.31	
and granodiorite (Tg)	10		0	- 2.2	
Valdez Group (KJv)				0.01	
Chitina Valley Batholith (Jc)	10		0.01	-10.60	
Gabbro (Rg)	1 .			0.79	
Nikolai Greenstone (Rn)					
Skolai Group (PPs)	00.				
Monzonitic-granitic complex (Pm)	5		0.02	- 2.62	
Gabbro and orthogneiss (Pgo)				- 6.30	
Kaskawulsh Group of Kindle (1953) (Pzk)	6		0	- 0.10	
Most of these samples were not originally selected for erties, and the values of magnetic susceptibility are values for a particular map unit. Moreover, too few have any statistical validity. The measurements do netization of several of the major rock units. Remarkave been measured for a large number of samples of the major volcanic rocks. These samples were collected by	e not comp samples we provide ide nent magnet the Nikola	letely represent ere measured for eas on ranges ar tization and sus i Greenstone and	tative of the restriction that the restriction to t	of true results tree of made of true of made of made of made of the contract of the contract of the contract of true results o	to ag-

As a crude rule-of-thumb, rocks having susceptibilities of less than about 1.0×10^{-3} emu/cm³ are nonmagnetic to weakly magnetic; those having susceptibilities in the range of 1.0-3.0x10-3emu/cm³ are moderately magnetic; and those having susceptibilities greater than 3.0x10⁻³emu/cm³

nian volcanic rocks. These samples were collected by Richard Doell for a paleomagnetic

Magnetic expression of major rock units

In the following discussion, apparent magnetic properties and expression of major rock units are described, and some anomalies in covered areas are interpreted. We must emphasize that detailed geological interpretation of each anomaly is far beyond the scope of this brief . Full analysis requires complete evaluation of not only the magnetic properties of the rock units but also the structural setting and thickness of the units.

An aeromagnetic interpretation map, sheet 2, has been prepared to aid in rapid analysis of general features of the aeromagnetic map. The map was compiled in the following manner: first, the aeromagnetic map (sheet 1) was spectrally colored in increment of 100, 500, and 1000 gammas. This enabled visualization of prominent highs and lows and allowed rough estimation of anomaly amplitudes as compared with the surrounding level of the magnetic field. Then, apparent magnetizations were subjectively assigned to areas of positive anomalies on the following scale:

I, weakly to moderately magnetic, anomaly amplitudes 50-200 gammas; II, moderately magnetic, anomaly amplitudes 100-300 gammas; III, strongly magnetic, 300-600 gammas; IV, very strongly magnetic, anomaly amplitudes 100-300 gammas; IV, very strongly magnetic, anomaly amplitudes 500-1500 gammas. The Roman numerals shown indicate the highest levels of apparent magnetization within an anomaly area. Many relative negative anomalies are caused by reversed remanent magnetization, and such anomaly areas are labeled R. Some apparent negative anomalies coincide with low topography and glaciers or ice fields; these areas are labeled R?. Many small negative anomalies on the north or northeast flanks of positive anomalies. are probably normal polarization lows. Boundaries of magnetic areas, shown as solid lines on sheet 2, are very approximately located on the steep gradients, which probably represent the maximum extent of magnetic objects at these high latitudes where the Earth's main field has a steep inclination (75°). Several zones of linear steepened magnetic gradients have been recognized. Some of these coincide with or closely parallel known fault zones, whereas others do not coincide with mapped faults at the surface. t coincide with mapped faults at the surface.

Within each anomaly area we have assigned a geologic symbol to indicate the most probable

parallel to the mapped traces of the Totschunda fault but appears to be offset 2 km or more to the southwest of the fault in the northern part, crosses the fault in T. 3 S., R. 22 E., source of the anomaly. As some anomalies are clearly composite, they are indicated by two or more geologic symbols. Areas without symbols are not characterized by conspicuous anomalies.

It must be emphasized that boundaries, magnetizations, and probable sources shown on the interpretation map are highly subjective. Specific anomalies over major rock units

Qu - Alluvial and glacial deposits are generally nonmagnetic to weakly magnetic as expressed at a level of 300 m above the ground surface. Thus anomalies over alluvium of the Chitina River Valley are caused by underlying magnetic rocks.

QTw - The extremely complex "birdseye" pattern over the Wrangell Lava is typical of volcanic sequences having variable magnetite content and normal and reversed magnetization. Susceptibilities are moderate, but the rocks have intense remanent magnetization. Anomalies tend to be of relatively short wavelength and moderate amplitude. Most of the Wrangell Lava seems to cause positive anomalies, but anomalies caused by reversed remanent magnetization are probable in many areas. For example, relative negative anomalies in T. 2 N., Rs. 11 and 12 E.; T. 2 N., Rs. 15 and 16 E.; and Tps. 1 and 2 N., Rs. 17 and 18 E. are almost certainly reversed because they partly occur over topographically high areas. Other areas of negative anomalies may be caused by remanent agnetization, but they occur over topographic lows or glaciers. These areas are

Several magnetic highs have amplitudes of 500 to 1500 gammas or more over the Wrangell Lava. Such anomalies are not typical of silicic to intermediate volcanic rocks. But the presence of large-amplitude lows indicates intense remanent magnetization, hence large highs are equally expectable. In the Nabesna quadrangle, to the north, the Klein Creek pluton commonly causes anomalies of very large amplitude, so we postulate that the Klein Creek type or even more mafic plutons buried beneath the Wrangell Lava should be considered as a possible source.

Th-Tg - Hypabyssal felsic intrusive rocks (Th) and granodiorite (Tg) have magnetic patterns hat are similar to those over the Wrangell Lava: some bodies are strongly magnetized and others are moderately to weakly magnetized. Four samples have susceptibilities greater than $1.0 \times 10^{-3} emu/cm^3$. For complete analysis, one must determine which plutons are stocks and which are sills or small dikes. Thin sills and dikes generally ack the volume to produce significant anomalies. Some known or inferred granodiorite bodies cause magnetic anomalies in regions of geochemical anomalies, especially the highs of several hundred gammas in Tps. 6 and 7 S., Rs. 16 and 17 E.

- Granodiorite and tonalite plutons that intrude the Valdez Group in the southwest part of the map are nonmagnetic to weakly magnetic.

Kkg - The few exposures of the Klein Creek pluton in the northeast corner of the quadrangle merit special attention because of the possible occurrence of copper mineralizatio Mean susceptibility of six samples of fresh Cretaceous granodiorite and diorite from the Nabesna quadrangle is 2.61x10⁻³emu/cm³, and susceptibilities clearly decrease with increased alteration (Griscom, 1975). Nearly all of the most northerly exposures of granitic rocks in the McCarthy quadrangle correlate with magnetic highs. Mineralized areas of Klein Creek to the north in the Nabesna quadrangle (Richter, 1976; Griscom, 1975) are commonly associated with hydrothermally altered plutonic rocks. These his suggest the presence of plutons but do not indicate extensive hydrothermal alteration in the McCarthy quadrangle. Where low magnetic values occur along flight lines that cross outcrops of the Klein Creek pluton, geochemical sampling should be carried out. The very large highs in T. 2 N., Rs. 19-22 E., and in Tps. 1 N., Rs. 19 and 20 E. and Tps. 1 N. and 1 S., Rs. 23 and 24 E. might actually be caused by a buried pluton of Klein Creek type, or even a more mafic type, rather than by the Wrangell Lava

K - The shelf and shallow-water clastic and carbonate deposits of the Cretaceous sequence should be largely nonmagnetic, and, indeed, absence of strong closed positive anomalies along MacColl Ridge and near Young Creek, Tps. 7 and 8 S., Rs. 15-17 E., suggests that the sequence is nonmagnetic. In several areas dominated by exposed Cretaceous sedimentary rocks, however, especially in T. 8 S., Rs. 18 and 19 E., a large positive anomaly over the Cretaceous sedimentary rocks suggests magnetic rocks at shallow depth. he source is probably Nikolai Greenstone beneath the Cretaceous sequence. ther large positive anomalies occur over Cretaceous rocks in Tps. 6 and 7 S., Rs 16 and 17 E., where partly buried sources are indicated. Some exposures of granodiorite (Tg) occur at two of the anomalies, and these could be sources. However, deeper magnetic units, such as Nikolai Greenstone may also cause these anomalies.

Kc - Sedimentary and volcanic rocks of the Chisana Formation in the northeastern part of the quadrangle are generally weakly magnetic. Apparent highs over most exposures are more probably caused by the Klein Creek pluton or by edge effects of Wrangell Lava. KJs - The small areas of turbidites of Jurassic and Cretaceous age in the northeast quarter

caused by adjacent bodies of the Klein Creek pluton and possibly by edge effects of KJv - Argillite, graywacke, and slate of the Valdez Group in the southwest corner of the uadrangle are some of the least magnetic rocks of the quadrangle. Anomalies over the Valdez terrane are of very low amplitude—only a few tens of gammas—and of very gentle gradients. This is expectable over flysch sequences, which normally have a low magnetite content. Some of the small anomalies show no correlation with topography, and their sources probably lie below the Valdez or represent effects of small

plutons or volcanic rocks within the Valdez. Jc - The Chitina Valley batholith is compositionally variable but is mainly tonalite and granodiorite. Most susceptibility values are in the range of 1.0 to 2.0x10-3emu/cm3. impositional diversity is indicated by the variable magnetic expression of the unit Along the south-central edge of the quadrangle, the rocks are moderately to strongly magnetic and cause numerous highs of several hundred gammas that correlate with high topography. A few negative anomalies, however, suggest lower magnetite content, perhaps due to rock alteration, especially the lows in T. 10 S., R. 16 E., R. 17 E., and R. 19 E. Batholithic exposures in the extreme west-central part of the quadrangle are less strongly magnetized and are characterized by flat gradients and even negative closures. Exposures in the northwest part of the quadrangle appear to be magnetic,

MacKevett, E. M., Jr., Albert, N. R., Barnes, D. F., Case, J. E., Robinson, Keith, and Singer, D. A., 1976, The Alaskan Mineral Resource Assessment Program: Background information to although the anomaly patterns are influenced by adjacent bodies of Nikolai Greenstor and Wrangell Lava. However, of special interest is the magnetic low in T. 3 S., R.

- The McCarthy Formation and Nizina and Chitistone Limestones should be nearly nonmagnetic. Thus, where anomalies occur over the outcrop of these units, deeper sources must be suspected. For example, the highs in T. 4 S., Rs. 11-13 E. may be caused by underlying Nikolai Greenstone or by some of the Tertiary intrusive rocks. Similarly, highs in Tps. 5 and 6 S., and Rs. 16 and 17 E. are almost certainly generated by the inderlying Nikolai. The marine Jurassic rocks are nearly nonmagnetic. Anomalies over this terrane are probably caused by Nikolai Greenstone or by plutons.
- Triassic gabbros in Tps. 4 and 5 S., R. 18 E. apparently cause small magnetic highs, although adjacent masses of Wrangell Lava and Nikolai Greenstone may contribute to

- The Nikolai Greenstone appears to be an internally complex magnetic unit. Some segments cause prominent positive anomalies, especially over topographically high areas. This is generally so for Nikolai in the west half of the map area. In parts of the central and southeastern parts of the map area, much of the Nikolai is either relanmagnetic or has apparent reversed remanent magnetization, for example in T. 4 S., Rs. 17 and 18 E., and in Tps. 1 and 2 S., Rs. 19 and 20 E.

Measured magnetic properties of several hundred samples of Nikolai Greenstone likewise indicate that it is a moderately to strongly magnetic unit. Susceptibilities of most samples are in the range 1.0×10^{-3} to 3.0×10^{-3} emu/cm³. Most samples have a large component of remanent magnetization, and Q-values, the ratio of remanent to induced magnetization, are commonly 1 to 2. Thus, aeromagnetic anomalies over the Nikolai are strongly influenced by the structural orientation of the unit with respect to the vector sum of the induced and remanent magnetization. Paleomagnetic studies in progress in March 1975 by J. M. Hillhouse will provide data for later quantitative analysis of anomalies over the Nikolai.

- Although some positive anomalies occur over volcanic rocks of the Station Creek Formation, parts of the unit are nonmagnetic to weakly magnetic. Seventeen susceptibiliies are greater than 1.0×10^{-3} emu/cm³. The main zone of positive anomalies occurs in ps. 4-8 S., Rs. 18 and 19 E. In the same area, however, are numerous plutons of Pennsylvanian (Pgo) and Triassic (Fig) gabbro, and Tertiary plutons (Tg), all of which are magnetic and which probably contribute to the anomalies. Small patches of Wrangell Lava may also cause some of the anomalies over the Station Creek terrane.

The sedimentary rocks of the Hasen Creek Formation and limestone of the Hasen Creek are not magnetic. Many of the apparent anomalies in areas where these rocks crop out are probably caused by adjacent magnetic units such as Station Creek Formation, Nikolai Greenstone, or Wrangell Lava.

PPsm - Most of the metamorphosed Skolai Group appears to be only weakly or moderately magnetic, especially in areas west of 143°. A few strong positive anomalies occur over these rocks in Tps. 9 and 10 S., Rs. 14-16 E. These highs are probably caused by amphibolites, although they may be caused in part by underlying magnetic units. The positive anomaly over the Border Ranges fault in Tps. 9 and 10 S., Rs. 14 and 15 E. is of special interest. If the anomaly is, indeed, caused by the metamorphosed Skolai Group, these rocks are probably present at depth south of the trace of the fault; that is, the fault surface probably has a southerly dip. The magnetic high in T. 9 S., . 21 and 22 E. could be caused by either metamorphosed Skolai Group or by a pluton of the monzonitic-granitic complex (Pm).

 The monzonitic-granitic complex in the southeastern part of the quadrangle is generally of moderate to strong magnetization. Magnetic highs occur over most exposures. However, a rather large magnetic low occurs over topographically high areas in Tps. 6 and 7 S., R. 21 E. Reversed remanent magnetization might cause this low, but it appears more likely that the granitic rocks here are a thin sheet that rests on the upper plate of the west-dipping thrust. It is also possible that the low is caused by hydrothermal alteration of magnetite in the monzonitic-granitic rocks. The large magnetic high in the SE $_4$ Tp. 9 S., R. 23 E. may be a composite high caused by both the Kaskawulsh Group of Kindle (1953) (Pzk) and monzonitic-granitic rocks.

Gabbro and orthogneiss in the west-central part of the quadrangle are moderately to strongly magnetic. The conspicuous, complex magnetic high in Tps. 5 and 6 S., Rs. 10-12 E. is clearly correlative with this rock unit. From the large amplitude and proximity to the exposed gabbro, one may infer that the anomalies along the line between Tps. 5 and 6 S., Rs. 8-11 E., near the area where the Chitina River leaves the quadrangle, are likewise caused by gabbroic masses concealed beneath the surficial cover. Magnetic highs in Tps. 6 and 7 S., R. 19 E. may be caused by gabbroic

In the southeastern part of the quadrangle, the Kaskawulsh Group of Kindle (1953), of marble, schist, phyllite, and minor amphibolite, is surprisingly magnetic in places. Several positive anomalies of a few hundred gammas correlate well with topographic highs over the unit, especially in Tps. 5-9 S., Rs. 22-24 E. Several conspicuous north-trending magnetic lineaments occur within and adjacent to the Kaskawulsh terrane. One of the westerly lineaments locally coincides with a west-dipping reverse (or thrust) fault zone. A program of sample collection and ground magnetic surveys of the Kaskawulsh at the sites of the magnetic highs should aid in determining if the source of these anomalies lies at greater depth.

Magnetic lineaments

The most conspicuous magnetic lineament in the McCarthy quadrangle is the Totschunda lineament, which trends northwest in the northeast quarter of the quadrangle. The magnetic lineament has been placed along the zone of steepened magnetic gradient. It lies closely and lies northeast of the fault on the east border of the quadrangle. An elong low lies southwest of the lineament shown on sheet 2. The cause of this low is most uncertain. In general it does not correlate with low topography. As it coincides with either the Nikolai Greenstone or Wrangell Lava, it may represent a reversed remanent zone that fortutously parallels the fault. Perhaps more likely is that the Totschunda zone is quite wide, and that milling and alteration in the fault zone have caused a loss of magnetization. In either event, the cause of the low should be investigated further by detailed sampling programs and, perhaps, by ground magnetic profiles.

Griscom (1975) has shown that 20-25 km of right-lateral offset across the Totschunda ault is consistent with the geologic and magnetic data in the Nabesna quadrangle to the north. In the McCarthy quadrangle, the geologic relations across the fault permit such an interpre-

tation, but the magnetic patterns are inconclusive. In the southeast quarter of the map, two magnetic lineaments trend northerly in Tps. 6-9 S., Rs. 21 and 22 E. The western lineament coincides closely with a north-trending segment of a reverse fault but diverges from the mapped fault in Tps. 6 and 7 S. An unmapped fault

in the Kaskawulsh terrane may be postulated along the eastern lineament.

everal magnetic lineaments trend northwest across the central and southwest parts of the quadrangle. In the extreme southwest, the Border Ranges fault zone may be the cause of a rather inconspicuous zone of steepened magnetic gradient. The steepened gradient coincides with or occurs a few kilometers south of the mapped trace of the fault. If this magnetic neament is, indeed, caused by the Border Ranges fault, the fault zone may be wider than shown on the generalized geologic map or the fault may have a southward dip in Rs. 12-14 E. the presence of a Tertiary pluton of unknown magnetic properties is a complicating factor.

The northwest-trending lineament near the Chitina River in the south-central part of the quadrangle seems to form an envelope to a zone of reverse faults that dip southwest. This maglineament breaks into two splays near the confluence of the Chitina and Nizina Rivers. One major splay trends west-northwest as the southern envelope of the series of complex reverse faults near the Gilahina and Kuskulana Rivers. This lineament may be the boundary between major geologic provinces. The late Paleozoic Skolai terrane occurs south of the splay and outcrops of the early Mesozoic Nikolai Greenstone occur to the north of the splay. This splay also lies

along a major northwest-trending gravity gradient that separates values of the Bouguer anomaly field into areas of -50 to -150 mgals to the northeast (thicker crust) from areas of -50 or more positive (thinner crust) to the southwest (Barnes, 1976). A second major splay trends westward from the major boundary in T. 6 S., Rs. 9-12 E. along the Chitina River Valley. It seems to form the southern boundary of a zone of Pennsylvanian gabbros. A more poorly defined magnetic lineament trends northwest from T. 6 S., R. 16 E. to T. N., R. 9 E. Tectonic significance of this lineament is obscure, but it crudely forms the orthern border of a block of topographically high terrain southwest of the Nabesna and other glaciers. Some faults parallel the magnetic lineament in Tps. 4 and 5 S., Rs. 14 and 15 E., but the faults lie 3-5 km north of the steepest gradients. Along the northwestern two-thirds of its length, this lineament marks the northeast limit of the Nikolai Greenstone and a belt

of Tertiary hypabyssal rocks.

A northwest-trending magnetic lineament in Tps. 4-6 S., Rs. 15-18 E. closely parallels a zone of southwestward-dipping reverse faults. This lineament may extend northwest into T. 3 S., R. 14 E. The northwestern part of the lineament marks the limit of the Nikolai Greenstone. Lineaments in Tps. 5-7 S., Rs. 16-18 E., do not appear to coincide with mapped faults.

Several bedrock units are the host of known or potential ore deposits in the McCarthy quadrangle. Many of the plutonic intrusions, ranging from dioritic to granitic in composition, are the site of prospects or geochemical anomalies for several metals, especially copper, gold, silver, molybdenum, lead, and zinc. Perhaps the most significant in the northern part of the quadrangle are the plutons of the Klein Creek type, which may contain copper deposits, espeally where hydrothermal alteration has occurred. Plutons of the Chitina Valley type, in the southern part of the quadrangle, where geochemical anomalies of copper and other metals occur,

The huge composite high in T. 1 S., Rs. 23 and 24 E., northeast of the Totschunda lineament, indicates the presence of at least two large magnetic bodies at depth. The larger is at least 10 km across, and the smaller, centered in T. 1 S., R. 24 E., is at least 5 km across. A complex ring dike, perhaps mafic, may be suspected at depth.

Limestones that are host to the Kennecott type of copper deposits are not magnetic. But Limestones that are nost to the Kennecott type of copper deposits are not magnetic. But because they are everywhere underlain by the Nikolai Greenstone, they can be indirectly traced beneath cover of younger deposits by magnetic mapping of the concealed Nikolai. For example, the large magnetic high in T. 8 S., R. 18 E., over Cretaceous sedimentary rocks, is interpreted to be caused by Nikolai at depth. If this is a correct interpretation, there is at least a chance that the Nizina and Chitistone Limestones are likewise present at depth. Whether a systematic relation exists between geochemical anomalies, prospects, and the

major lineaments has yet to be determined. A crude parallelism exists between geochemical anomalies and the Totschunda fault zone, but this may merely reflect accidental geochemical ample points. Similarly, many prospects and geochemical anomalies occur in the band that rends northwest across the central part of the quadrangle, where several major lineaments are postulated from the magnetic data. This band, of course, is where the Nikolai Greenstone and associated sedimentary rocks are concentrated, and where Tertiary plutons and plutons of the Chitina Valley type appear to be associated with geochemical anomalies.

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accompany folio of geologic and mineral resource maps of the McCarthy quadrangle, Alaska: U.S. Geol. Survey Circ. 739 (in press):

9 E., which in part is caused by low topography. The low may also be related to some alteration in the batholith, which occurs on both sides of the valley of the Kuskulana River. This region is one of geochemical anomalies. Richter, D. H., 1976, Geologic map of the Nabesna quadrangle, Alaska: U.S. Geol. Survey Misc. Geol. Inv. Map I-932, scale 1:250,000.